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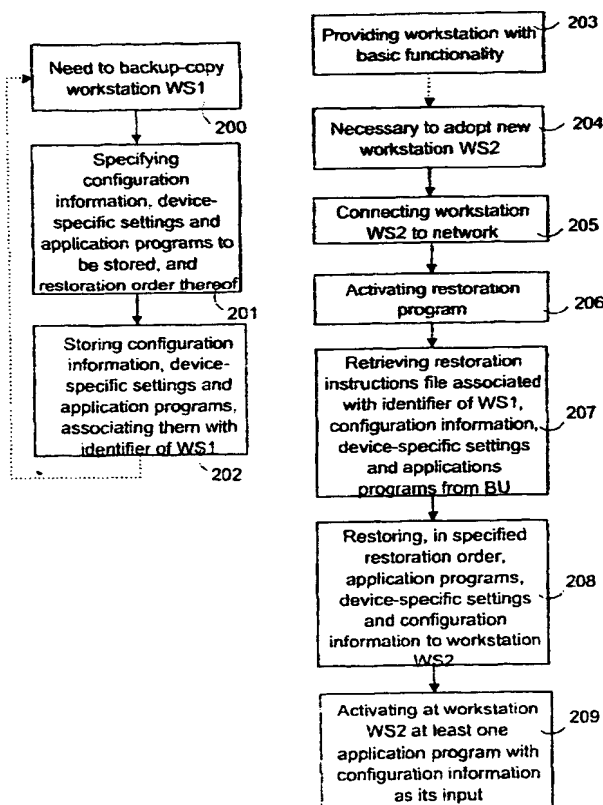
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20010515 14 March 2001 (14.03.2001) FI(71) Applicant (for all designated States except US): METSO  
AUTOMATION NETWORKS OY [FI/FI]; Lentokent-  
tänkatu 11, FIN-33900 Tampere (FI).

(72) Inventors; and

(75) Inventors/Applicants (for US only): ROIHUPALO,  
Kimmo [FI/FI]; Kreetantie 8 B 7, FIN-33950 Pirkkala  
(FI). PURA, Ari-Pekka [FI/FI]; Haiharankatu 22 B 9,  
FIN-33710 Tampere (FI). VILJAMAA, Juha [FI/FI];  
Siirtolapuutarhankatu 3 B 25, FIN-33900 Tampere  
(FI). TYYNELÄ, Markku [FI/FI]; Solkiniitynkatu 20,  
FIN-33710 Tampere (FI).(74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23,  
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(54) Title: ADOPTION OF WORKSTATION IN INFORMATION SYSTEM OF PROCESS CONTROL ENVIRONMENT



(57) Abstract: A method for adopting a workstation in an information system of a process control environment, the information system comprising a plurality of workstations and at least one backup unit. For backup-copying, application programs, configuration information and device-specific setting of a first workstation and a restoration order thereof are specified. The application programs, configuration information and device-specific settings of a first workstation are stored in the backup unit, associating them with an identifier of the first workstation. The application programs, configuration information and device-specific settings associated with the identifier of the first workstation are restored from the backup unit to at least one workstation in a predetermined restoration order when the information system is in need of a workstation substantially similar to the first workstation. At least one application program is activated at the workstation with configuration as its input.

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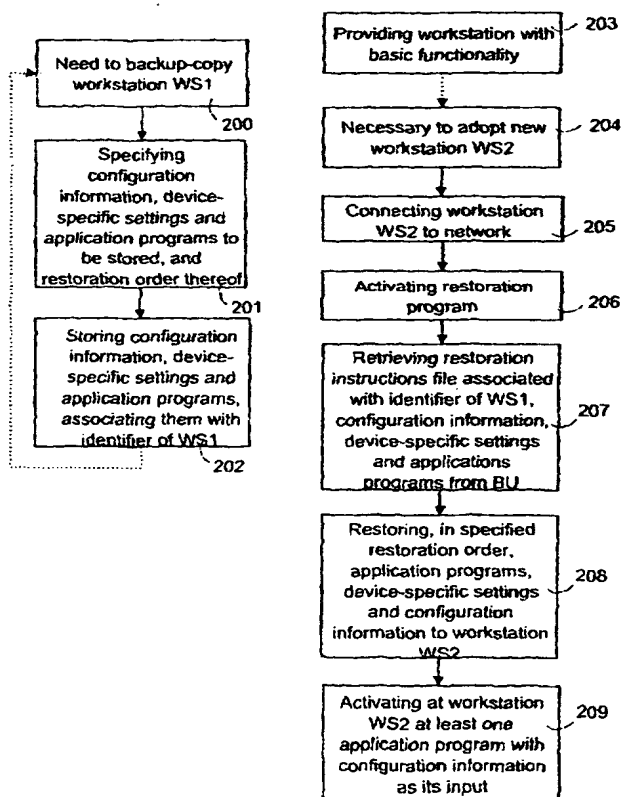
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(54) Title: ADOPTION OF A WORKSTATION IN AN INFORMATION SYSTEM OF A PROCESS CONTROL ENVIRONMENT



(57) Abstract: A method for adopting a workstation in an information system of a process control environment, the information system comprising a plurality of workstations and at least one backup unit. For backup-copying, application programs, configuration information and device-specific setting of a first workstation and a restoration order thereof are specified. The application programs, configuration information and device-specific settings of a first workstation are stored in the backup unit, associating them with an identifier of the first workstation. The application programs, configuration information and device-specific settings associated with the identifier of the first workstation are restored from the backup unit to at least one workstation in a predetermined restoration order when the information system is in need of a workstation substantially similar to the first workstation. At least one application program is activated at the workstation with configuration as its input.

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## **ADOPTION OF WORKSTATION IN INFORMATION SYSTEM OF PROCESS CONTROL ENVIRONMENT**

### **BACKGROUND OF THE INVENTION**

The invention relates to adopting a workstation in an information system of a process control environment, and particularly to backup-copying data into a backup unit and restoring stored data from the backup unit.

In an industrial process, a highly-automated process control system is used for ensuring that the process works in an appropriate manner. An industrial process, such as a paper making process or a power station process, is an extremely large-scale and complicated process which includes many variables. The information system of a process environment is responsible for various tasks related to collecting, sharing, storing and presenting process properties, and to controlling the process. Typically, an information system comprises a large number of workstations that are either independent ones or that are used by an operator. These workstations are often PC devices having an operating system, peripheral units, such as a network interface card, and application programs installed therein.

A workstation in an information system is usually assigned a process-related task, e.g. giving an alarm due to process malfunction. At the workstation of the information system, one or more application programs are executed with configuration information as their input, thus enabling the workstation to fulfil its special task in the information system. Configuration information contains application-program-specific and typically also workstation-specific parameters and settings. Configuration information controls the operation of one or more application programs; for example, it specifies the data transfer settings and waiting times to be used, or links to necessary resources (e.g. a database). Configuration information may also specify application program files (names of application program files to be executed) that are executed for a subfunction. Configuration information is usually collected and combined into a separate file. According to the prior art, configuration information comprising specific application parameters can, if necessary, be stored in a backup station, wherefrom such information can be restored to a workstation.

It may become necessary to replace a workstation e.g. due to equipment malfunction. Successful replacement usually requires knowledge of automation systems and familiarity with computers, especially with operating

systems. The problem with the above-described arrangement is that it is laborious and time-consuming to replace a workstation with a new one, and it usually requires some assistance from a computer expert. It is important to be able to replace a workstation with a new one within a short time in order to minimize the harm caused to a process by workstation malfunction. Even if the configuration information were successfully loaded from the backup station into a new workstation, it is still necessary to install all necessary application programs and various device-specific settings in the new workstation in order to enable the new workstation to fulfil its task in the information system. Typically, application programs reside on different CD-ROMs, from which they have to be installed in a workstation one by one.

So called disc-imaging programs for PC devices are also widely known, wherein a disc copy of a PC device is stored on a server, wherefrom it can, when necessary, be restored later. The disc-imaging programs are, however, hardware-dependent, which means that restoration requires that the hardware configuration to which the restoration is to be carried out should be exactly similar e.g. to the previous hardware that was executed at the particular location (of which hardware the disc copy was made) or that there should be an appropriate disc copy separately stored for each different hardware configuration. The disc-imaging programs are thus well suited e.g. to PC devices for educational uses that typically include several devices provided with similar hardware and software configurations. The numerous workstations used in a process control system do not, however, have similar configurations. The different hardware configurations of substitutive equipment to be used later are not, however, always known, which means that a copy made by a known disc-imaging program cannot be restored to the substitutive device.

## BRIEF DESCRIPTION OF THE INVENTION

An object of the invention is thus to provide a method and a system implementing the method so as to enable a user to replace a workstation in an information system of a process control environment in a quicker and easier manner. The objects of the invention are achieved by the method, information system and computer program that are characterized by what is disclosed in the independent claims. Preferred embodiments of the invention are disclosed in the dependent claims.

According to the invention, instead of backup-copying an entire disc copy, only specific hardware-independent data is backup-copied; after a workstation breakdown, the hardware configuration of the copied device is no longer relevant but any device having an appropriate operating system installed therein can be used as a substitutive device.

On the basis of a predetermined storing setting, the workstations are then configured to automatically store application programs, configuration information and device-specific settings into a backup unit, associating them with workstation-specific identifiers. The stored application programs, configuration information and device-specific settings are, in a predetermined order, restored from the backup unit to at least one workstation which includes an operating system when a workstation substantially operationally in accordance with the first workstation is needed in the information system, the new workstation thus being capable of replacing the first workstation in the information system and commencing the execution of tasks assigned to the first workstation. Next, the workstation can deploy the restored data and activate at least one application program with the configuration information as its input, thus enabling the workstation to fulfil its typically process-related task in the information system. Configuration information refers to information used as inputs of one or more application programs to be executed on a workstation. Device-specific settings may include workstation-specific hardware settings and workstation-specific software settings.

An advantage of the method and system of the invention is that it enables quick and easy replacement of a workstation since programs, configuration information and device-specific settings can be restored from a backup unit. When carried out in a predetermined order, it is possible to implement restoration successfully, and as easily for a user as possible. When a new workstation has been connected to a network, the user only needs to activate a restoration program which, with the identifier of a first workstation as its input, restores all the necessary application programs, configuration information and device-specific settings, whereafter a workstation in accordance with the first workstation can be adopted. When storing takes place automatically on the basis of a predetermined storing setting, the user does not have to worry about backup copies or their updates.

According to a preferred embodiment of the invention, application programs, configuration information and device-specific settings are packed

into one backup file in a backup unit. This enables the disc space of the backup unit to be saved and information to be easily found workstation-specifically.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention is now described in closer detail in connection with the preferred embodiments and with reference to the accompanying drawings, in which

Figure 1 is a block diagram showing a process control system,

Figure 2 is a flow diagram showing a method according to a preferred embodiment of the invention.

#### DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 1, an information system of a process control environment typically comprises a plurality of workstations WS, servers SE, databases DB and at least one backup unit BU. For illustrative reasons, the databases DB in Figure 1 are located separately; usually, however, they are integrated into the servers SE. There can be several different types of workstations WS: engineering workstations, process control workstations, diagnostics workstations, operator workstations and alarm workstations. The process workstations WS typically operate at the interface between a process and an information system, and they are operatively connected to different sensors S and process equipment control means CM. The workstations WS comprise memory MEM, a user interface UI (typically at least a display, keyboard and a mouse), I/O means I/O (typically a network interface card and software controlling data transfer) and a central processing unit CPU comprising one or more processors. An information system can, however, also comprise workstations controlled via a network, having no user interface UI. The memory MEM comprises a non-volatile part for storing a program code controlling the CPU and a read-write memory part to be used for processing data. The memory MEM is also used for storing configuration information and device-specific settings. Typically, the backup unit BU is a separate workstation to whose memory the backup-copyings according to the invention are carried out from the plurality of workstations WS.

Figure 2 illustrates a method according to a preferred embodiment of the invention wherein a new workstation is adopted. Assume that a first workstation WS1 is already in use, and data is to be backup-copied 200 from



this workstation. Advantageously, the backup-copying is carried out after the new workstation has been adopted and/or after some information (an entire directory/file) to be copied has been changed. Storing can also be executed automatically at regular intervals. The automatic starting time of backup-copying can be specified by a start setting; a user or an administrator may also start backup-copying.

Preferably, a backup program is activated at the workstation WS1 to specify 201 the data to be stored, i.e. configuration information, device-specific settings and application programs and a restoration order thereof. The backup program can be stored in the memory MEM of the workstation WS1, wherefrom it can be retrieved to be executed by the CPU. Preferably, backup-copying is automatic, which means that at least one application program, configuration information and device-specific settings of the first workstation WS1, the restoration order and the start storing setting thereof are for the first time specified in the backup program manually. These constitute the backup program storing instructions which, to a large extent, can be specified before the backup program is adopted. The specifications are preferably stored in a storing instructions file, wherefrom they can be modified as necessary, e.g. when the start storing setting is to be changed. The storing instructions file thus enables the backup program of the workstation WS1 to automatically specify 201 the data to be stored. The restoration order can be specified in the backup program simply on the basis of the data to be stored (at least one application program, configuration information and device-specific settings) contained in the storing instructions file inputted into the backup program.

The backup program retrieves the data to be stored from the memory MEM of the workstation WS1 e.g. at a moment specified by the start setting, and stores 202 the data in the backup unit BU, associating it with the identifier of the WS1. The identifier of the workstation WS is any logical identifier that can be used for distinguishing the workstations WS from each other. Preferably simultaneously with storing 202 the data, the restoration instructions file, which comprises restoration instructions as to how to restore the configuration information, device-specific settings and application programs, is also stored. The restoration instructions comprise at least partly the same information as the storing instructions controlling the operation of the backup program. The restoration instructions comprise information about the restoration order, i.e. the order in which files/directories are to be restored. The restoration order

may also specify the order in which the necessary installation programs are to be executed. The restoration order, like other information in the restoration instructions file, is preferably stored in the backup unit BU. The restoration order may also simply be specified through the storing order, in which case the restoration (208) takes place in the storing order or in an order reverse thereto.

The application programs to be stored comprise different application files to be executed. The parameters used as the input of the application files are stored in the configuration information. In addition to the parameters described above, the configuration information may contain e.g. environment variables of application programs, file names of other application programs to be activated from an application program, and register information. The device-specific settings comprise different workstation-specific settings, such as user-interface-related settings specified by a user. Device-specific settings typically comprise operating-system-specific settings, e.g. the name of a workstation or a setting of application files to be automatically started at a workstation. For example, certain register settings of an operating system should be stored in the backup unit BU even if the operating system is not stored. The device-specific settings may include the network settings to be adopted, such as an IP address, subnetwork mask, network identity of a default router/gateway or a network identity of a device. It should be noted that all specified 201 data is not necessarily in file form although thus assumed in the description below.

The backup program preferably retrieves directories that include application programs, device-specific settings and configuration information, packs them into one backup file and stores 202 the backup file in the backup unit BU, associating the data to be stored with the identifier of the WS1. The directories of the files to be backup-copied have preferably been specified in the backup program already in advance (specified in the storing instructions file of the backup program); it is also possible to specify the files to be stored in greater detail. The packed backup file can be given the identifier of the WS1, which makes the file easily distinguishable.

Prior to adoption, a basic functionality is installed 203 in new workstations, i.e. typically an operating system and a network interface card are installed therein. Preferably, a basic functionality is installed 203 in a plurality of workstations already before it even becomes necessary to adopt a new workstation in order to replace a broken one, for example. The actual replacement can thus be carried out quickly, and the adoption is easy. When it be-

comes necessary 204 to adopt a new, second workstation WS2, the workstation WS2 is connected 205 to the network. The basic functionality being installed 203 almost entirely, the connecting 205 is easy since only the physical connecting and specifying the basic network settings remain to be carried out. The device-specific settings to be restored may, however, also include network settings, in which case the network settings of the workstation WS2 can be changed later according to those settings.

The restoration program which, according to a preferred embodiment, is of the same application as the backup program, is activated 206 at the workstation WS2. The functionality of the restoration program and the backup program described in connection with Figure 2 may also be a part of another application, it may be e.g. a part of a management application of the workstations of a process. If the second workstation WS2 is to be substantially in accordance with the first workstation WS1, the restoration program is given the identifier of the WS1. The identifier can be given e.g. by a user by means of the keyboard of the user interface UI. Alternatively, the user feeds e.g. a diskette which contains a restoration program and the identifier of the WS1 into the WS2 and activates the restoration program. The identifier of the WS1 can also be obtained by transferring a "lock part" from the workstation WS1 to the workstation WS2. The restoration program retrieves 207 the stored data, i.e. the application programs, device-specific settings and the configuration information, on the basis of the identifier of the WS1.

According to a preferred embodiment, the restoration instructions file associated with the identifier of the WS1 has been stored in the BU, the restoration instructions file also controlling the operation of the restoration program. The restoration program first retrieves 207 the restoration instructions file and operates according to the restoration instructions, such as the restoration order, disclosed therein. The restoration program may retrieve the packed backup file to the WS2 and unpack the packing.

The application programs, configuration information and device-specific settings are restored 208 in the specified restoration order to the second workstation WS2. The restoration program then stores the necessary directories including their files in the order specified by the restoration instructions file and changes the device-specific settings as necessary. In order to operate, some application programs require installation through their own installation program. According to a preferred embodiment of the invention, the

restoration instructions contain installation instructions on the execution of installation programs. The restoration program then activates the installation programs in accordance with the installation instructions in the specified order, in which case the restoration order can be considered to also include the order in which the application programs are to be executed. All this takes place automatically without any intervention by the user, and the necessary restoration-related restoration instructions are obtained from the restoration instructions file. When the data to be stored is correctly specified (201) and correctly restored (208), particularly in the correct order, the new workstation WS2 is able to operate in a similar manner to that of the WS1 even if the hardware of the WS2 were not identical to that of the WS1.

After the restoration 208 has been carried out, the workstation WS2 can be adopted by restarting it. Preferably, the restoration program restarts the workstation WS2 automatically; subsequently, the application programs specified in a start file are activated. At least one application program is activated automatically 209 with restored configuration information as its input, which enables the workstation WS2 to perform the task specified in the configuration information, e.g. serving as an alarm workstation. Consequently, the information system is provided with a workstation WS2 substantially in accordance with the workstation WS1, the workstation WS2 being capable of proceeding with the tasks specified for the workstation WS1.

According to a preferred embodiment of the invention, data is not packed into a workstation-specific backup file but directories with similar contents are stored 202 only once. Directories to be compared with the directories in the BU are specified 201 for the backup program, and only the directories that have changed are stored 202 in connection with backup-copying. The advantage of this embodiment is that the number of bits in the data to be transferred is reduced, which necessitates less data transfer capacity.

The previous embodiment can also be applied such that the BU is provided with only one backup copy per directory, which makes it unnecessary to store a corresponding directory stored by another workstation in connection with the backup-copying 202 of a workstation. The comparison can be carried out on the basis of a directory name and/or correspondence between directory sizes. This saves memory, compared to each workstation WS having the application programs, device-specific settings and configuration information separately stored therein. The application program files in particular are the same in

several workstations WS, whereas the device-specific settings typically have to be stored workstation-specifically. In order to make the data necessary in different workstations distinguishable, the backup program preferably associates, in a workstation-identifier-specific file, directories that are needed when a workstation is replaced. These directories and their locations (paths in the backup unit BU) are preferably specified in the restoration instructions file. The restoration program then retrieves the restoration instructions file in accordance with the identifier of the workstation (e.g. WS1) and restores (208) the application programs, device-specific settings and configuration information specified therein from the BU to the new workstation (WS2). Naturally, this embodiment can also be applied to files, i.e. files with similar contents are stored in the BU only once and the same files can be used as backup copies of several workstations. When the same directories or files are used as backup copies of several workstations, it should be ensured that no shared data is deleted prematurely.

It is to be noted that as distinct from the example of Figure 2, the application programs, configuration information and device-specific settings can also be restored to the same workstation WS1 from which they were copied. In this case, steps 206 to 209 can be executed. This enables a workstation to be restored to its previous state e.g. after inadvertent deletion of a directory or after a hard disk breakdown or replacement. The application programs, configuration information and device-specific settings of the backup unit BU can also be backup-copied in the above-illustrated manner to another backup station and restore them when necessary therefrom.

According to an embodiment, the storing function works both ways, in which case files/directories that need to be stored from a network to a workstation are specified in the system. When, for example, a program is being updated, the application programs and/or configuration information to be updated can be stored in the BU to replace the programs and information that were backup-copied earlier. From the backup unit BU, the changed data is further stored in the workstation WS. The directories (files) can be specified in the backup program, which, after being activated, compares the directories of the workstation and the backup unit BU and stores the changed directories automatically in the workstations WS, replacing the previous ones. It is also possible that data is stored in the workstation WS by means of the application pro-

gram of the network in all workstations containing directories (files) that have changed while in use.

The invention can be applied to any information system of a process control environment without being restricted to the system disclosed in Figure 1. The functions illustrated in Figure 2 are preferably implemented by executing a program code loaded from a separate memory means (MEM or external memory means, such as a diskette or a CD-ROM) or a network at one or more central processing units (CPU). It is obvious to one skilled in the art that as technology advances, the basic idea of the invention can be implemented in many different ways. The invention and its embodiments are thus not restricted to the examples described above but may vary within the scope of the claims.

## CLAIMS

1. A method for adopting a workstation in an information system of a process control environment, the information system comprising a plurality of workstations and at least one backup unit into which configuration information on at least one workstation is stored, **characterized by**

specifying, for backup-copying, at least one application program, configuration information and device-specific settings of a first workstation, a restoration order and a start storing setting thereof,

storing automatically at least one application program, configuration information and device-specific settings of the first workstation into the backup unit in accordance with the start storing setting, associating them with an identifier of the first workstation,

restoring, in the specified restoration order, the application programs, configuration information and device-specific settings associated with the identifier of the first workstation from the backup unit to at least one workstation containing an operating system in response to a workstation substantially similar to the first workstation being needed in the information system, and

activating, at the workstation, at least one restored application program with configuration information as its input.

2. A method as claimed in claim 1, **characterized by**

packing the application programs, configuration information and device-specific settings into at least one backup file, and

unpacking, at the workstation, the backup file after it has been retrieved from the backup unit.

3. A method as claimed in claim 1, **characterized by**

comparing the directories and/or files to be stored with the directories and/or files that have already been stored in the backup unit,

storing files and/or directories with similar contents in the backup unit only once,

associating at least one application program, configuration information and device-specific settings with the identifier of the first workstation in a separate file, and

restoring the at least one application program, configuration information and device-specific settings specified in the file to at least one workstation when necessary.

4. A method as claimed in any one of the preceding claims, **characterized by**

installing an operating system and necessary means for data transfer in the workstation to be adopted,

loading a restoration program into the workstation before the workstation is adopted,

retrieving, from the backup unit, a restoration instructions file containing the restoration order and other restoration-related instructions,

executing the restoration program at the workstation, which results in restoration and activation of at least one application program in accordance with the restoration instructions file, and

restarting the workstation.

5. A method as claimed in claim 4, **characterized by**

the restoration instructions containing installation instructions for executing installation programs, and

executing, at the workstation, the installation programs in an order specified by the installation instructions.

6. A method as claimed in any one of the preceding claims, **characterized by**

replacing, at the backup unit, application programs and/or configuration information of at least the first workstation with updated application programs and/or configuration information, and

storing the updated application programs and/or configuration information from the backup unit to at least the first workstation.

7. An information system of a process control environment, the information system comprising a plurality of workstations and at least one backup unit into which at least one workstation is arranged to store configuration information, **characterized** in that the information system is, by software, arranged to

store, automatically and in accordance with a predetermined start storing setting, predetermined at least one application program, configuration information and device-specific settings of at least one first workstation into a backup unit, associating them with an identifier of the first workstation,



restore, in a predetermined restoration order, the application programs, configuration information and device-specific settings associated with the identifier of the first workstation from the backup unit to at least one workstation containing an operating system in response to at least one workstation substantially similar to the first workstation being needed in the information system, and

execute at least one restored application program at the workstation with configuration information as its input.

8. An information system as claimed in claim 7, **characterized** in that the information system is, by software, further arranged to

pack the application programs, configuration information and device-specific settings into at least one backup file, and

unpack the backup file before it is loaded into the workstation.

9. An information system as claimed in claim 7, **characterized** in that the information system is, by software, further arranged to

compare the directories and/or files to be stored with the directories and/or files that have already been stored in the backup unit, and

store files and/or directories with similar contents in the backup unit only once.

10. An information system as claimed in any one of claims 7 to 9, **characterized** by the information system comprising a program code whose execution results in

storing, in the backup unit, a restoration instructions file containing at least a restoration order and installation instructions specifying the execution of installation files,

retrieving the restoration instructions file from the backup unit to the at least one workstation, and

restoring and executing the necessary installation programs in accordance with the restoration instructions file.

11. A computer program loadable into a memory of a computer for controlling at least one workstation of an information system of a process control environment, **characterized** in that the computer program comprises:

a computer program code for storing, automatically and in accordance with a predetermined start storing setting, predetermined at least one application program, configuration information and device-specific settings

contained in the workstation into a backup unit in the information system, associating them with an identifier of the workstation.

12. A computer program loadable into a memory of a computer for controlling at least one workstation of an information system of a process control environment, the workstation including an operating system, **characterized** in that the computer program comprises:

a program code for restoring, in a predetermined restoration order, application programs, configuration information and device-specific settings associated with an identifier of another workstation from a backup unit contained in the information system to the workstation including an operating system in response to the fact that the workstation including an operating system is to become substantially similar to the other workstation as far as the information system is concerned, and

a program code for executing at least one restored application program at the workstation which includes an operating system with configuration information as its input.

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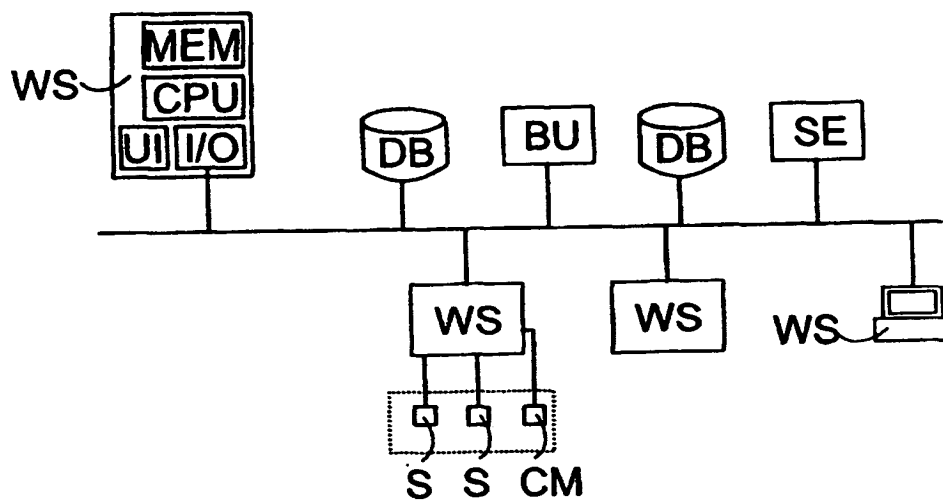


Fig. 1

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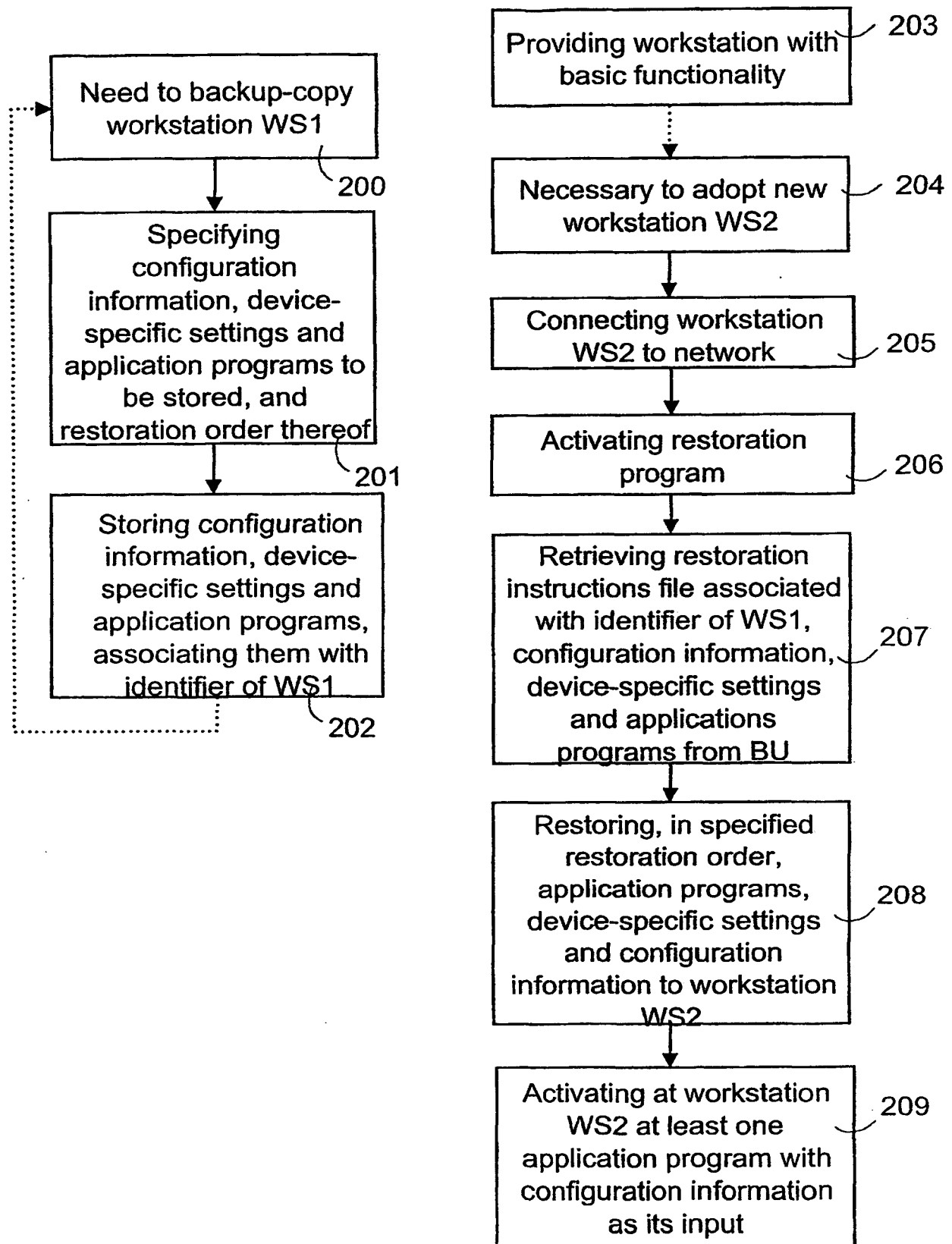


Fig. 2

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 02/00200

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G06F 11/14, G06F 15/177

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, INTERNET

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6070250 A (YEAGER, R.L. ET AL), 30 May 2000 (30.05.00), column 2, line 33 - column 3, line 36, abstract  --	1-12
A	WO 0036503 A2 (PCFIRST.COM, INC.), 22 June 2000 (22.06.00), page 3, line 19 - page 5, line 12, claims 1,3,16-17,19,30, abstract  --	1-12
A	US 6038379 A (FLETCHER, D.J. ET AL), 14 March 2000 (14.03.00), column 2, line 23 - line 59, claim 1, abstract  --	1-12

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
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"&" document member of the same patent family

Date of the actual completion of the international search

26 June 2002

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Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Pär Heimdahl /OGU  
Telephone No. +46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 02/00200

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5717930 A (IMAI, T. ET AL), 10 February 1998 (10.02.98), column 2, line 43 - column 4, line 67, figure 1, claim 1, abstract  --	1-12
P,A	FR 2808349 A1 (NEARTEK S.A.), 2 November 2001 (02.11.01), page 2, line 11 - page 3, line 31, claim 1, abstract  --	1-12
L	"Workstation Image Development" [White Paper] [on line]. Mobius Consulting, February 1999 [retrieved on 2002-06-24]. Retrieved from the Internet: <URL:http://www.virtuosic.com/tech/wksimage.pdf>  --	1-12
L	PC Transplant Pro [Datasheet] [on line]. altiris, inc., @2002 [retrieved on 2002-06-24] Retrieved from the internet: <URL:http://www.altiris.com/products/docs/ pctransplant.pdf>, the whole document.  -- -----	1-12

## INTERNATIONAL SEARCH REPORT

Information on patent family members

10/06/02

International application No.

PCT/FI 02/00200

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